

# RESERVE COPY PATENT SPECIFICATION

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## COMPLETE SPECIFICATION

### NO DRAWINGS

### Improvements in and relating to Thermoplastic Films

We, T. J. SMITH & NEPHEW LIMITED, a British Company, of Neptune Street, Hull, Yorkshire, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—  
This invention relates to thermoplastic films formed by extrusion and blowing.

- 10 The normal method for producing thermoplastic film by extrusion and blowing is to extrude the hot plastic mix through an annular die and to blow up the extrusion, as it emerges from the die, into a bubble. When the film is set it is passed to
- 15 nip rolls for reeling as a double thickness or flattened sleeve of film. The double thickness is slit to form sheets of single thickness.
- 20 Using this method of manufacture, it is extremely difficult to produce films free from pinholes. The presence of pinholes renders the film unsuitable for many forms of packaging and other purposes.
- 25 According to the present invention there is provided a process for the production of thermoplastic films that comprises extruding a thermoplastics material through an annular die, inflating the tube formed
- 30 and collapsing the inflated tube between the nip rolls just before the position of the frost line to produce a laminated lay-flat film.

- 35 For a thermoplastic material to be suitable for use in the process of the present invention it is only necessary that films formed from the material, when at a temperature above the softening point, can stick to each other when pressed together.
- 40 Thermoplastic materials that satisfy this criterion include polyethylene, polypropylene, polyvinyl chloride, ethylene/vinyl

acetate copolymer and polyvinylidene chloride.

The term "frost line" may be defined as follows. When a thermoplastic material is extruded and then cooled there is a point when the transparent extruded material becomes translucent due to crystallisation occurring in the thermoplastics material. 50 The point at which the material becomes translucent is called the frost line.

Using the method of the present invention the two internal contacting surfaces of the flattened bubble of film are still hot 55 when they contact each other. Accordingly they bond together to produce a film twice as thick as the blown film.

A particular advantage of the present invention is that it is extremely unlikely that 60 any pinholes in one lamination will coincide with pinholes in the other lamination. Therefore the laminated film is free from pinholes right through, and suitable for industries requiring such pinhole-free film 65 for packaging and other purposes.

To bring the "frost line" into an advantageous position for the purposes of the invention, the temperature of the air (or other gases) used to form the bubble may 70 be high enough to allow the extruded film to expand to the required diameter before the nipping-together and resulting lamination. Moreover, the pressure of the gas may be adjustable for the purpose and if required the nipping rolls may be heated. It 75 also may be advantageous to form or coat the nipping rolls with a material, for example polytetrafluoroethylene, to prevent the film from adhering thereto. Additionally, the atmosphere around the exterior 80 of the extruded material, particularly the bubble, may be kept at a required temperature and possibly within a shielding means,

to slow down the cooling action and enable the invention to be carried into effect.

The present invention also includes a thermoplastic film produced by the above described process.

WHAT WE CLAIM IS:—

1. A process for the production of thermoplastic films that comprises extruding a thermoplastic material through an annular die, inflating the tube formed and collapsing the inflated tube between the nip rolls just before the position of the frost line to produce a laminated lay-flat film.

2. A process as claimed in claim 1 in which the thermoplastic material is polyethylene, polypropylene, polyvinyl chloride, ethylene/vinyl acetate copolymer or polyvinylidene chloride.

3. A process as claimed in claim 1 or claim 2 in which the rate of cooling of the film is controlled by the temperature of the gas used to form the bubble.

4. A method as claimed in any preceding claim in which the nip rollers are heated.

5. Process as claimed in any preceding claim in which the nip rollers are formed from or coated with a non-adherent material.

6. Process as claimed in claim 5 in which the non-adherent material is polytetrafluoroethylene.

7. Process as claimed in any preceding claim in which the temperature of the atmosphere around the exterior of the extruded tube is controlled so that the cooling of the tube is slowed down.

8. A process as claimed in claim 7 in which the temperature of the atmosphere around the exterior of the extruded film is protected by shield means.

9. A process for the production of thermoplastic film as hereinbefore described.

10. A thermoplastic film when produced by the process of any preceding claim.

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